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AUTHOR Plecki, Margaret L.
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ABSTRACT

This article reviews the contributions and limitations of economic analyses of resource allocation policies aimed at improving teacher quality. Two analytic frameworks taken from the study of the economics of education are employed: productivity theory and human capital theory. The article first summarizes results of various economic analyses of the productivity of resources and discusses the strengths and limitations of this approach for informing questions about investments in teacher quality. Next, the aspects of human capital theory, which are relevant to the issue of resource allocation for the development of teachers' capabilities and careers, are presented. These aspects are considered in addressing two teacher policy arenas in which resource allocation is a critical feature: teacher compensation and professional development. The paper concludes that this review of economic perspectives from human capital and productivity theories has implications for the design and implementation of investment policies targeted at improving teacher quality. It explores some of the possible implications for policymakers when faced with resource allocation decisions regarding policies aimed at improving teacher quality. (Contains 70 references.) (SM)

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Economic perspectives on investments in teacher quality:

Lessons learned and implications for policy

Margaret L. Plecki
University of Washington
Center for the Study of Teaching and Policy
Box 353600
Seattle, WA 98195
email: mplecki@u.washington.edu

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Investing in improving the quality of teachers and teaching is a central feature of many current education reform efforts at all levels of the policymaking system. Numerous calls for the improvement of teacher quality exist, and many states and local communities are targeting resources to ensure that all children have access to quality teachers. Many of the policy initiatives being considered require an increased level of investment in programs, training, and opportunities which support the ability of teachers to improve the level of student learning. Consequently, expectations are also increasing that the new investments will result in positive and enhanced outcomes for students.

Policymakers bear a responsibility for the equitable and productive management of resources as they address questions of how to best support the improvement of the quality of teaching and learning. Difficult choices must be made regarding the distribution and use of a constrained set of resources targeted at improving teacher quality. Consequently, specific information about which improvement strategies hold promise can improve the understanding of the tensions and trade-offs which may exist under a particular set of educational conditions.

At the core of investments in the quality of teachers and teaching is some concept of teacher development. Either explicitly, or implicitly, policymakers presume that the resources they allocate purchase learning opportunities, offer incentives, and otherwise underwrite activities that—over time—develop the capabilities of teachers. These capabilities are further assumed to be the most immediate "cause" of student learning. Across the span of a teacher's career, these accumulating capabilities are likely to be associated with evidence of improved student performance.

This article reviews the contributions and the limitations of economic analyses of resource allocation policies aimed at improving teacher quality. Two analytic frameworks taken from the study of the economics of education are employed in this review: productivity theory and human capital theory. The article first summarizes results of various economic analyses of the productivity of resources, and discusses the strengths and limitations of this

approach for informing questions about investments in teacher quality. Next the aspects of human capital theory which are relevant to the issue of resource allocation for the development of teachers' capabilities and careers are presented. These aspects are considered in addressing two teacher policy arenas in which resource allocation is a critical feature: teacher compensation and teacher professional development. The paper concludes with considerations for policymakers when faced with resource allocation decisions regarding policies aimed at improving teacher quality.

Inquiry about productivity

Let us first consider the premise that when policymakers decide how to best invest in strategies designed to support teacher development, they are faced with the issue of educational productivity—that is, what results (e.g., student achievement levels) are produced by investments in teacher development? Questions such as the following are key considerations in policy debates: What are the best approaches for getting the most for our educational dollar? How do we best support teachers in a climate of increased standards and expectations for student learning? How do we best reach the full spectrum of teachers and students in need of improvement? What do we know about existing efforts to improve teacher quality? The answers to these questions are complex and variable. The nature and the extent of the educational challenges differ in important ways at each level of the policymaking system (state, district, school, and classroom) and the specific conditions of students and teachers within each level of the system vary considerably. Each question emphasizes the need to better understand whether or not we are utilizing resources devoted to teacher development in the most efficient or equitable manner.

In order to wrestle with the notion of how productivity studies can inform teacher policy issues, we will briefly examine some of the existing research on productivity in education. A historical review of the literature indicates that there has been considerable debate in the research community about the manner in which increased spending on

education may or may not be related to improved performance. However, this does not mean that inquiry regarding productivity does not have value. Instead, understanding the nature of the conceptual challenges involved in conducting such investigations of productivity may shed light on the strengths and weaknesses of any particular set of policy strategies. That is, facing the difficulties of specifying the exact nature of the costs and benefits to be derived from a set of policies can be a valuable can provide valuable insights which might be used in the process of selecting from competing demands for resources.

For the most part, studies of educational productivity have examined the relationship between the amount of money spent on various educational "inputs" and the levels of student achievement that are presumed to be associated with these inputs. These studies, typically referred to as education production function research, derive much of their conceptual framework from the microeconomic theory of the firm. The production function model attempts to analyze the relationship between inputs and outputs. The goal of this inquiry is to investigate the changes in output (typically measured by student achievement test scores) associated with changes in the levels or mix of educational inputs (e.g., per-pupil expenditures, teacher characteristics, and teacher-student ratios, with some statistical controls for variations in student background and family characteristics). Production function research can also be viewed as an analytic frame in which cost/benefit analyses can be conducted.

Several significant conceptual and technical problems surface when attempting to apply a production function theory to educational productivity. Conceptually, the lack of agreement about the elements of a theoretically sound "theory of production" in education plagues the research in this area. In other words, unlike the microeconomic theory of the firm, the forces and conditions that comprise the human "equation" of student learning are neither obvious or fully understood. The lack of agreement is understandable, given that education is characterized by interactive and developmental processes stretching across many years of schooling. Given the lack of an agreed upon theory of educational production, it is

little wonder that technical issues abound, such as the specification and measurement of proxies to best represent the important elements in the educational process. Hence, the choice of inputs and their metric specifications may rest on other than strong theoretical grounds. Production function researchers typically choose particular input or output measures because information is readily available, the variable has some policy relevance, or because the variable is intuitively plausible (Monk, 1990).

Conceptual and technical problems notwithstanding, researchers have repeatedly used production function theory and techniques to examine the way investments may have affected educational outcomes. While the results are mixed and in some dispute, they do offer insights into the relevance or impact of investments in teacher quality aimed at improving student learning.

A seminal article on the subject of educational productivity (Hanushek, 1981) claimed that after reviewing 130 studies of educational productivity, no consistent, positive, significant relationships could be uncovered between increased spending on education and improved student achievement. Subsequent reviews by the same author (Hanushek, 1986, 1989, 1991) yielded the same general result. These analyses have been central to a continuing policy debate about whether dollars matter in the quality or improvement of education. A re-examination of Hanushek's analysis of the literature, conducted by Hedges, Laine, and Greenwald (1994), arrived at a different conclusion: when alternative procedures for aggregating the results of separate studies are used, certain input measures—among them, factors related to teacher quality—do have a significant relationship to student outcomes. These authors found that teacher education, ability, and experience, along with small schools and lower teacher-pupil ratios, are all positively associated with student achievement. The difference in results is due to the use of an alternative methodology for conducting the meta-analysis of the same literature. Others who have reviewed prior production function research (Ferguson and Ladd, 1996) claim that many of the earlier analyses did not critically sort out

the methodologically weak studies from consideration, thus casting doubt on the validity of the conclusions being drawn.

Over the past two decades, there have been waves of productivity studies which have employed a more microanalytic approach using disaggregated data (Murnane, 1975; Summers and Wolfe, 1977; Thomas and Kemmerer, 1983; Brown and Saks, 1986; Rossmiller, 1986). These studies have focused on school and classroom levels, in contrast to the more typical studies or analyses which have used more global measures from macro-level databases. Findings from the microanalytic studies reveal a similar pattern of mixed results. However, several production function studies in this tradition have demonstrated positive relationships between teachers' ability levels (usually a measure of verbal aptitude) and student achievement (Ehrenberg and Brewer, 1995; Summers and Wolfe, 1977). Ferguson (1991) examined school districts in Texas and concluded that there are systematic relationships between educational inputs and student outcomes which he estimated to account for between one quarter and one third of student achievement differences. Ferguson and Ladd (1996) examined Alabama schools and concluded that there is evidence that the input variables of teacher's test scores, the percentage of teachers with master's degrees, and small class size are positively associated with student test scores. The authors assert that the use of more methodologically sound analytic techniques (e.g., value-added specification) combined with a more disaggregated analysis can address some of the perplexing problems which have been associated with production function research.

Accompanying the ongoing search for empirical relationships between inputs and outputs are doubts about the utility of the production function literature. Some argue that even when significant relationships are found between input variables and student outcomes, these results do not have useful policy implications (Witte, 1990; Murnane, 1991). Others question the appropriateness of the specific variables being used and the limitations imposed by an almost exclusive focus on test scores as the measure of student outcomes (Smith, Scoll, and Link, 1995). Furthermore, results from the production function research studies which

do not uncover a significant relationship between increased spending and increased student outcomes collide with the widely-held, rather common-sense belief shared by many educators and policymakers that increasing the level of investment makes—or can make—an important difference. Some researchers assert that insufficient attention paid to how additional dollars have been spent on education inputs may explain the apparent lack of connections between dollars and outcomes. For example, in an analysis of school district spending in New York state (Lankford and Wyckoff, 1996) researchers found that a sizable portion of the increased resources were allocated to special education programs for the disabled. Given that student outcome measures for disabled students are often unavailable or excluded from aggregate data sets, it is likely that this aspect of increased spending is not accounted for in some of the production function research.

Alternatives to the input-output predictive model for assessing educational productivity, noted in the literature, may hold promise for capturing more precisely how resource investments targeted to the quality of teaching may translate into improvements in student learning. Barnett (1994) suggests that embedding production function and cost function studies in the theoretical model of private firms may not be appropriate for understanding how resources are allocated in public school systems. Alternatively, he suggests models which are derived from theories about the bureaucratic behavior of government institutions (Nikansen, 1971) may more appropriately explain how educational resource allocation decisions are made and what impact these resources have. In this alternative view, the unit cost of the school is determined by the available revenue, not by the most effective way to allocate revenue, and school administrators strive to maximize revenues and allocate resources to keep employees responsive and cooperative and maintain the school's reputation. Hughes et al. (1993) find that while resource allocation in schools is more closely linked to funding those factors presumed to be related to quality or general school goals (e.g., better equipment and facilities, newer texts, additional support staff), these factors may not be directly linked to improved educational outcomes. To discover more

direct links between resources and outcomes, a line of inquiry in educational productivity research may be needed which elevates the importance of classroom-level analysis and complements the school-based studies (Monk, 1992). Elmore (1994) offers the observation that traditional budgeting practices in schools and school districts are not centered on determining the actual costs of educational inputs, but rather focus on either adding or subtracting dollars from a baseline budget. He also notes that educators typically do not have any special training or background to assist them with the complex problems embedded in budgeting and improving productivity. Odden and Clune (1995) discuss several factors related to low productivity, including a highly uneven distribution of resources across states, schools, districts, and students, unimaginative uses of dollars that do not translate into improved performance, and a focus on additional programs rather than results. The authors cite several areas where additional productivity research might be extended: research on increased course-taking at the secondary level, examination of organizational strategies which are associated with improved performance, and research on high-poverty schools.

The upshot of these lines of thinking and research to date are that we know less about the productive impact of policymakers' investments in teacher development than we might wish. To be sure, some analyses highlight certain teacher-related variables (teachers' verbal ability, education, and years of experience) that appear to bear some relationship to student learning. Other studies establish no clear or discernible relationships. The lack of connections and the mixed nature of results across studies may be due to the weaknesses in underlying theory or specification of measures. Or, these models have yet to represent adequately important variables intervening between allocation of resources and their enactment in practice. By a similar argument, production function models take little account of the actual allocation and expenditure dynamics within public education bureaucracies, and hence we are unable to tell whether increased levels of resource investment overall were actually targeted to inputs of immediate relevance to improved classroom performance.

Inquiry into human resource development

The shortcomings of educational productivity research leads one to consider other lines of economic analysis that are built on a more explicit theory regarding the improvement of teachers' capacity for their work. Research on policies that seek to develop and reward the "human resource" of the teacher force are particularly relevant. Research regarding the effective, efficient, and equitable use of human resources is a critically important area to investigate when considering policy options that are intended to support improved teacher quality. The bulk of operating expenditures in education are allocated to pay for the cost of employing school personnel, with the largest portion of those expenditures allocated to classroom teachers. Arguably, the quality of education is ultimately dependent on the classroom teacher's ability to produce educational outcomes. Two specific policy strategies for supporting teacher development—teacher compensation and investments in ongoing teacher professional development—are conceptually linked to theories of human resource development. As a point of departure, we begin by outlining findings from research on human capital theory that are applicable to both teacher compensation and professional development, and have contemporary significance in examining investments made in these two teacher development policy strategies.

Human Capital Theory and the Development of Teachers

The examination of human resource development has been a central area of study in the economics of education. One of the long-standing theories of human resource development, human capital theory, views human beings as individuals who possess great potential which can only be fully realized by making investments in human development. As far back as 1776, the publication of Adam Smith's *Wealth of Nations* offered at least two insights into the nature of human capital which have applicability to the contemporary discussion of investing resources in teacher development. The first of these is the observation that labor inputs are not purely quantitative. Second, Smith observes that

productivity is related to both "the quantity of the capital stock which is employed...and the particular way in which it is so employed." (Smith, 1776). These ideas suggest the importance of understanding both the "stock" and the "flow" of human resources (e.g., teacher's labor), as well as understanding the qualities of these resources. The evolution of human capital theory since Smith's time[1] suggests that at least three elements are related to the quality and productivity of human resources: the amount of human resources being employed, the quality of those human resources, and the way in which human resources interact in their employment.

These central ideas of human capital theory shed light on the thorny problem of measuring human resources and assessing their effects. The measurement of labor quality has been a subject of investigation by many who study the economics of education. Benson (1978) is one of several experts in the economics of education who has noted that we typically use proxies in order to judge the quality of labor inputs. He points out that education levels, degrees, and the acquisition of special credentials, the most common proxies for labor quality, are commonly used across all types of labor markets. Employers value education levels, degrees, and credentials because of a belief that these are acceptable proxies for valuable knowledge and skills that render the worker more productive in a particular type of labor market.

Proxies such as these have often been used to examine various policy strategies for improving teacher quality. We could reasonably assert that teachers who possesses higher levels of knowledge and skill in their craft will be associated with higher levels of productivity. While this assertion seems very obvious, the process of identifying teachers who possess higher levels of knowledge and skill is far from obvious. As is true in most professional labor markets, we search for reasonable proxies for the knowledge and skill of

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[1] For a contemporary review of the contributions made to the study of human capital theory, see Sweetland, S. (1996). "Human capital theory: Foundations of a field of inquiry," *Review of Educational Research* 66 (3), pp. 341-359.

teachers. In particular, scholars—especially those engaged in productivity research—have traditionally focused on years of experience in teaching, degrees and credentials earned, and levels of education and/or training beyond certification, often known as continuing education credits. Each of these proxies is typically associated with some type of resource allocation policy.

By applying lessons learned from human capital theory, we can expect that these proxies are insufficient measures of teacher quality, and, consequently, investments aimed only at these proxies are likely to render variable results. The proxies focus too much attention on quantity, are only loosely connected to quality, and to a large extent, ignore the matter of the way in which the resource is configured in its employment. Thus, the conceptual link between the human resource inputs and the productivity of those inputs is quite weak.

The perspective provided by the application of human capital theory is useful when considering resource allocation strategies for improving teacher quality. For example, investments which produce higher levels of education, credentials, and/or training for teachers may result in increased productivity. However, the extent to which these investments pay off is dependent on the closeness of the conceptual link between the types of education and training purchased and the knowledge and skills needed *and used* in the classroom context. Keeping the perspective of human capital theory in mind, we now consider two types of investments in teacher quality: professional development and teacher compensation.

Investments in professional development

Research on investments in professional development has tended to address a different set of questions than productivity studies. Here, studies seek to answer two questions primarily: (1) who invests what in professional development? (2) what do these investments purchase? A more limited set of studies offer answers to a third question: how

much and in what ways does professional development (and, by implication, investment in professional development) influence student learning? Virtually no studies address directly the question of the relation between investments of resources to support professional development and student learning measures.

Professional development for teachers has consisted of a myriad of activities and programs that are financed in a variety of ways from all levels of government. Several studies about the costs of staff development have been conducted (Moore and Hyde, 1981; Lytle, 1983; Stern, Gerritz, and Little, 1989; Elmore, 1997; Education Commission of the States, 1997) but an analysis of the available research indicates that there is little generalizable information about the range of resources which are allocated for professional development (Orlich and Evans, 1990). Nonetheless, there are clear modal patterns regarding what these resources buy. One study found that teachers are two to three times more likely to be participants in a district-provided staff development than enrolled in a college or university course (Little, 1989). The same study also calculated that more than four-fifths of state dollars for staff development were controlled by the local district. A study by the Education Commission of the States (1997) found that approximately three-fourths of school district resources designated for professional development are spent on teacher inservice days, conferences, and workshops.

Professional development activities have been dominated by a training-based delivery system, generally managed by school districts, which offers teachers a variety of workshops targeted on special projects or narrowly defined aspects of reform (Little, 1993). This type of packaged professional development is not well suited to current educational reform purposes and ignores the opportunities to learn that are part of the school organization (Hargreaves, 1990, 1993). Not surprisingly, scholars have increasingly noted the need to have professional development practices more crucially linked to the improvement of student performance (Darling-Hammond and McLaughlin, 1995).

The systemic reform initiatives during the past ten years have emphasized the importance of high standards for all students, a thinking-oriented curriculum, and performance-based student assessments linked to the standards (Resnick, 1993). Educational reform based on standards and performance-based assessment implies a focus on the development of new professional knowledge and skills which teachers will need to produce an elevated level of student outcomes. The particular set of required knowledge and skills would vary by the context and conditions of the individual school setting (Cohen, McLaughlin, and Talbert, 1993). Efforts underway by the National Board for Professional Teaching Standards and the National Commission on Teaching and America's Future are two examples of the types of efforts underway to improve teacher recruitment, preparation, certification, continual development, and retention.

Some efforts have been made to calculate the costs of resources currently being devoted to the continuing education of teachers. Miller, Lord and Dorney's (1994) estimates range between 1.8% and 2.8% of the district's operating budget. The cost per regular classroom teacher ranged between $1,755 and $3,259. Their study was based on a series of intensive case studies in four districts located in different regions in the U.S., ranging in size from 9,500 to 125,000 students. The estimates are based on direct costs such as the salaries of district and school administrators, and substitute teachers as well as on the direct costs of materials and supplies. One detailed study of staff development in California (Little et al., 1987) estimated the investment in professional development to be almost two percent of total funding for education in that state. In a study of one New York school district, Elmore (1997) estimated that spending on professional development amounted to about three percent of the total budget. One long-standing observation has been that school districts with more than one percent of its budget allocated to professional development is an exception (Darling-Hammond, 1994; Houston and Freiberg, 1979). These studies do not consider, however, that most districts, somewhat due to the requirements of the bargained contracts with teachers, compensate teachers for staff development activities through an increase in

salary, thus representing a "hidden" cost of traditionally-delivered staff development. For example, a study of spending on professional development in the Los Angeles Unified School District (Ross, 1994) found that the district expended $1,153 million in teacher salaries in 1991-92, and that 22% of this figure could be attributed to salary point credits that were earned because of courses or other approved professional development activities on the part of teachers. The analysis goes on to call several of the features of the salary point credit system into question and makes proposals for improving the current investment being made in teachers' professional development.

As the example of investing in professional development through salary increments implies, there is a pronounced difficulty in fully accounting for all the costs incurred. Professional development activities frequently are financed through a combination of revenue sources, including non-governmental sources, thereby complicating the cost accounting. Professional development experiences also might be associated with substantial contributions of volunteer time on the part of teachers (Little et al., 1987). At the same time, teachers might accrue additional credits for professional development activities which advance them on the salary schedule, resulting in a long-term fiscal obligation to the district in the form of the resultant base salary increase. Finally, similar professional development activities might vary significantly in costs per teacher depending on the financing strategy which is employed. For example, one strategy for supporting teacher professional development which is increasing in popularity is the "early release" option in which students are released from school on some regular basis, thereby allowing time during regular school hours for teachers to engage in professional development. This option clearly is less costly for school districts, as it removes the additional costs of substitutes or additional hours worked by teachers. However, there is a significant opportunity cost borne by students in the form of reduced instructional time.

The studies of professional development costs briefly reviewed above concentrate on the more traditional forms of professional development delivery. However, significant

changes have been taking place in recent years regarding the conceptualization of effective teacher professional development (Fullan, 1993; Little, 1993; Smylie, 1995), resulting in significant re-thinking of how professional development is best provided (National Foundation for the Improvement of Education, 1996; Darling-Hammond & Ball, 1997). This re-conceptualization of professional development presents a number of conceptual and technical challenges for cost studies,[2] including methods for assigning costs to professional development activities which are integrated into the instructional day and/or more informal interactions among teachers. Moreover, recent thinking about professional development raises questions about whether investments in conventional staff development are likely to contribute much to improving the quality of teaching.

Teacher compensation

Historically, teachers have been compensated for their efforts through a system which is based on an entry level salary. The base salary is then augmented by increments on an established salary schedule based primarily on years of teaching experience and levels of additional education (such as advanced degrees or credit for professional development activities). The level of teacher compensation is a perennial resource allocation question and is primarily determined by decisions about the salary schedule. While the argument can be made that raising compensation levels will assist in attracting and retaining quality teachers, the traditional form of teacher compensation, based on the two factors of years of experience and levels of education and training, does not provide the formula for producing the very best teachers. Consequently, research on teacher compensation has attempted to uncover the types of incentive systems which are more closely linked to improved quality of teaching and student learning.

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[2] For a discussion of these cost implications, see Rice, J.K. (1999) "Recent trends in the theory and practice of teacher professional development: implications for cost," paper presented at the annual conference of the American Education Finance Association, March 18-20, 1999.

In the past two decades, a variety of reforms to the traditional system of teacher compensation have been attempted. During the early 1980s, merit pay was re-introduced as a policy alternative. In principle, merit pay individually rewards teachers based on the performance of their duties. Some merit pay plans provide for an individual financial bonus on a yearly basis, while other plans call for a permanent advancement on the salary schedule (Darling-Hammond and Berry, 1988). In many instances where they have been tried, merit pay systems have been abandoned, primarily due to internal dissension and problems determining who would receive the additional pay (Murnane and Cohen, 1986; Robinson, 1983). In addition to merit pay proposals, the idea of teacher career ladders has been put forth as another type of alternative compensation strategy, but programs based on this idea have met with a similar lack of success (Freiberg and Knight, 1991; Bellon et al., 1989; Southern Regional Education Board, 1994).

Why have the various attempts at altering teacher compensation borne so few fruitful results? One possible explanation is that the traditional salary structure provides for horizontal equity. That is, teachers are treated as equals on the salary schedule regardless of their gender, race, or teaching assignment (Protsik, 1996). This well-established practice provides for a uniformity of application across teachers which is resistant to change. Others assert that teachers are primarily motivated by intrinsic rewards which result from the process of working as a teacher (Lortie, 1975; Conley and Levinson, 1993; Richardson, 1990) rather than changes in compensation rates. Firestone (1991) offers the view that research on merit pay has not sufficiently considered the relationship between money and teacher motivation. Firestone distinguishes between merit pay systems (which reward some teachers for doing essentially the same work better than other teachers) and job enlargement reforms (which provide additional compensation to teachers for doing different work) and agues that job enlargement is more closely linked to teachers' intrinsic motivations.

Another explanation is that prior reforms in compensation have focused on individually-based rewards rather than rewards for group performance. An alternative

approach to teacher compensation suggested by Mohrman, Mohrman, and Odden (1996) includes group-based performance rewards as well as skill-based and competency-based pay. The authors emphasize that the basis for determining the specific skills, competencies, and group rewards must be that the rewards support the central educational purposes of the school and are well-suited to the type of organizational arrangements which define the particular site. Further work on the development of alternative designs for compensation systems which are more tightly connected to school improvement have been advanced by Odden and Kelley (1997). Finally, the work of the National Board for Professional Teaching Standards provides a basis for compensating teachers' knowledge and skills by demonstrating the achievement of higher levels of knowledge and expertise through the use of a rigorous professional review process.

Research also has been conducted regarding the alignment of compensation strategies with various education organizational designs. Kelley (1997) notes that historically teacher compensation has been viewed as separate from other aspects of reforming educational organizations. The author analyzes how compensation systems differ under four types of organizational models: scientific management, effective schools, content-driven, and high standards/high involvement and recommends that the design of teacher compensation systems should be better fitted to the type of organizational design which represents the school setting in which teachers work, including the organization's structure, values, and goals. There are states (e.g., Kentucky and South Carolina) and local school systems (e.g., Dallas, TX; Charlotte-Mecklenburg, NC; and a very recent pilot program in Denver, CO) which are in the process of implementing alternative compensation plans. Places where alternative compensation plans have been developed and implemented have relied on participation by educational administrators, teacher unions, and community members in the plan's design (Odden and Kelley, 1997).

Investments in teacher compensation, as in teacher professional development, are policies which have been commonly employed in efforts to improve teacher quality.

Research on human resource development, particularly that which is derived from human capital theory, indicates that the proxies which have been used to capture important elements of teacher quality (e.g., verbal aptitude, degree earned, and years of experience) provide an incomplete picture of the factors which affect teaching quality. Most of the research to date on human resource development in education has focused on tracking the quantity of particular inputs that are presumed to be positively associated with teacher quality. A critical need exists for research which attempts to advance our knowledge about the conceptual links between investments in teacher professional development, teacher compensation, and improved teacher and student performance.

Implications for policy and research

This review of economic perspectives from human capital and productivity theories has implications for the design and implementation of investment policies targeted at improving teacher quality. In this section, we explore some of the possible policy implications in an effort to stimulate thinking and dialogue among educators, researchers, and policymakers.

How can we consider the knowledge gained from economic perspectives in its application to current policy debates about teacher quality? One set of observations about how we might characterize knowledge gained from economic research on productivity and human capital and their implications for policy is provided below.

A significant challenge emerges from the lack of a solid conceptual framework for understanding the important elements in the education process. The lack of sophisticated models for the assessment of student learning needs, the application of teacher knowledge and skills in the instructional process, and the ways in which teachers enact a variety of resources to support instruction accounts for some of the existing shortcomings of econometric analyses of productivity. Many existing policy and resource allocation strategies for improving teacher quality are not theoretically linked to student outcomes.

This lack of sufficient knowledge about how policies and resources are enacted by teachers to improve the quality of teaching and learning is precisely the reason why it is so problematic to design cost-benefit analyses of existing investments in teacher quality.

Alongside the conceptual challenges, and in part derived from them, econometric perspectives on the productivity of investments in teacher development face a multitude of measurement challenges. First, and perhaps, most importantly, difficulties exist in specifying the student outcomes to be assessed. While significant progress has been made in productivity research, primarily in microanalytic studies, we still face the question of how to improve on our measures of student learning. Test scores provide an insufficient measure of the content, number, and types of performances expected by the ambitious learning standards that the education reform efforts of this decade have promoted. Adding to the complexity is the extent to which the selected set of standards are universally applied (Monk and Rice, in press). Consequently, analyses of the extent to which specific investments have resulted in improved efficiency (that is, improved student learning according to the set of standards being addressed) are ultimately dependent on our ability to develop clearer, more appropriate outcome measures. In a similar vein, improvement also is needed in the proxies we use for teacher quality. The typical proxies such as years of experience, scores on standardized tests of verbal ability, degrees and credentials earned, and academic field are insufficient indicators of teacher quality. However, current work on developing and implementing teacher standards (such as the National Board for Professional Teaching Standards and the INTASC standards) holds promise for the improvement of measurements of teacher quality.

The lessons learned from human capital theory, reviewed earlier, suggest that the quantity of a resource, the quality of a resource, and the ways in which a resource is configured in its employment are all important aspects of assessing the resource's productive potential. When we view the economic research on the relationship between resources, productivity, and teacher quality, we find that tracking "investments" in teacher quality have been mostly limited to tracking proxies for the *quantity* of a given resource. While economic

theory acknowledges the difference between the quantity and the quality of a given input, the research to date indicates that resource allocation strategies for improving teacher quality (1) overemphasize the effects of the quantity of resources, (2) give short shrift to the analysis of the effects of the quality of the resource, and (3) do little to illuminate the effects of re-configuring or reallocating resources—that is, does not help us get at the alternative uses of the same resources. Current economic models for examining the effectiveness of resource allocation practices targeted at teacher quality help articulate the challenges we must face, but are insufficient in their current state to provide the types of analyses that policymakers might find most useful.

In what ways might our conceptions of policy aimed at improving the quantity, quality, and reconfiguration of resources for teacher quality be improved? We might begin by first assuming that productivity can be improved through the re-allocation or re-configuration of existing resources. In other words, if we were to hold the overall quantities of resources constant, then we might focus more centrally on how the resources are allocated and used. There is a little research in this area, but recent work has pointed to the positive contributions and the efficiencies associated with redesigning resource allocation practices (Miles and Darling-Hammond, 1998; Miles, 1997; Odden & Busch, 1998). Resource re-allocation expands our traditional notions of how to bring resources to bear on the achievement of higher productivity. It also shifts the questions one asks, from those concerning the effects of incremental resource increases (a typical question in productivity research) to questions regarding the effects of alternative configurations of the same resource. In other words, rather than seeking a new program from a new funding source, resources are viewed as available for redesign in order to develop a more productive way of managing existing resources. One of the most prominent resources to be re-configured is the allocation of time which teachers spend with students and with other educators.

From a policy standpoint, resource re-allocation challenges the typical manner by which new policies or initiatives are introduced by policymakers for implementation by

educators. The press felt by policymakers to seek out solutions to problems faced in education often results in a response which includes the establishment of new guidelines, regulations, and/or opportunities, and may or may not be accompanied by the infusion of additional fiscal resources. That is, most education policies are not designed to be fiscally neutral. However, resource re-allocation assumes that there are no new dollars available for distribution. Rather, resources are shifted from the support of one program configuration or policy initiative to some other configuration or purpose. This implies that investment priorities change, resulting in the reduction or removal of goods or services that presumably were valued by some constituency. This shift is likely to encounter at least some resistance by those individuals or groups whose interests are perceived to be adversely affected by a particular re-allocation strategy. Consequently, policies which depend on resource re-allocation require a different approach than the traditional strategies of providing financial incentives for adopting particular policies or threats of loss of funding for failure to meet specific requirements.

There are multiple policy options that can influence teaching quality, each having implications for resource allocation or reallocation. Unless care is taken, however, investments in one policy may hinder the advancement of another, equally important aspect of teacher development. Let us consider the following example. One common and long-standing teacher compensation policy strategy has been focused on the goal of attracting and retaining higher quality teachers by raising salary levels. While human capital theory would indicate that this strategy has an evidentiary base, this policy might hinder the acceptance of other notions of compensation, such as skills-based pay. Another example taken from policies related to the provision of teacher professional development further illustrates the potential conflict among policy strategies. Traditional teacher compensation policies provide financial incentives for teachers who accrue additional continuing education credits. The acquisition of these credits is mostly within the purview of the individual teacher, and the type, amount, and quality of the offerings selected may or may not be an optimal match with

the types of knowledge and skills which might be most effective in supporting the teacher's work with students. Additionally, the typical manner in which these continuing education credits are delivered often run counter to current notions of best practice in professional development. To further complicate matters, professional development opportunities are also connected to special revenue sources,[3] each with their own set of guidelines and reporting requirements. Consequently, policymakers typically face a challenge when attempting to introduce new approaches to professional development as they will most likely face pressure to continue with existing forms of teacher compensation, add on new supports for the delivery of professional development, and ensure that activities which are undertaken meet the requirements of the various funding sources . Faced with this complexity, a crazy quilt approach to resource allocation for professional development often results. This mixed bag of resource allocation strategies does not take advantage of the potential opportunity for resource re-allocation fashioned through a more strategic approach. In short, without a comprehensive approach to policies which are aimed at improving teacher quality, it is unlikely that resources will be maximized.

Much work is being done throughout the nation to assist policymakers with the development of a comprehensive approach to addressing the improvement of teacher quality. The work of partner states who are collaborating with the National Commission on Teaching and America's Future is one such example of an effort to develop comprehensive policy strategies that support teacher quality. In order to maximize the effectiveness of this type of strategic approach, policymakers must also develop resource allocation policies which are responsive to and reflective of a comprehensive approach to investments in teacher quality.

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[3] Examples of special revenue sources at the federal level which contain funding for professional development include Title 1, Part A (Basic and Concentrated Grants), Title II (the Eisenhower Professional Development Program), Title II (the Technology Literacy Challenge Fund), Title IV (Safe and Drug-Free Schools and Communities), Title VI (the Innovative Education Program Strategies fund), and Goals 2000:Educate America Act. Numerous special funding sources for professional development exist at state and local levels as well.

In sum, economic perspectives can provide some useful insights in addressing the complex challenge of how resources can best be allocated for the improvement of teacher quality. Many questions regarding the effectiveness of resource allocation for this purpose remain. However, lessons learned from an economic perspective, particularly from human capital theory, indicate that we should be cautious of policy approaches which are simply additive. Instead, increased attention should be devoted to policies which focus on more finely tuned notions of teacher quality. Finally, initial work which investigates policies and practices which result in the re-configuration of existing resources ought to be significantly expanded.

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